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| FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371 | | ATTORNEY'S DOCKET NUMBER: T01-4929/TS U.S. APPL. NO. [Unknown, Sec. 47 C.F.R. 1.5] <div style="font-size: 1.5em; font-weight: bold; color: blue;">1070009764</div> |
| INTERNATIONAL APPLICATION NO.: PCT/JP00/03897 | INTERNATIONAL FILING DATE: 15 JUNE 2000 (15.06.00) | PRIORITY DATE CLAIMED: 15 JUNE 1999 (15.06.99) |
| TITLE OF INVENTION: METHOD FOR MANUFACTURING A FILTER ELEMENT | | |
| APPLICANT(S) FOR DO/EO/US: Kunimoto SUGIYAMA and Tadayuki ONODA | | |
| Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information: | | |
| 1. <input checked="" type="checkbox"/> | This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. | |
| 2. <input type="checkbox"/> | This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. | |
| 3. <input checked="" type="checkbox"/> | This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). | |
| 4. <input checked="" type="checkbox"/> | A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. | |
| 5. <input checked="" type="checkbox"/> | A copy of the International Application as filed (35 U.S.C. 371(c)(2)) | |
| 6. <input checked="" type="checkbox"/> | a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau <i>--in Japanese language</i>). b. <input type="checkbox"/> has been transmitted by the International Bureau. (see attached copy of PCT/IB/308) c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). | |
| 7. <input checked="" type="checkbox"/> | A translation of the International Application into English (35 U.S.C. 371(c)(2)). | |
| 8. <input type="checkbox"/> | Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)). | |
| 9. <input type="checkbox"/> | a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. | |
| 10. <input type="checkbox"/> | A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). | |
| 11. <input checked="" type="checkbox"/> | An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). | |
| 12. <input type="checkbox"/> | A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). | |
| Item 11. to 16. below concern document(s) or information included: | | |
| 13. <input checked="" type="checkbox"/> | An Information Disclosure Statement under 37 CFR 1.97 and 1.98. | |
| 14. <input checked="" type="checkbox"/> | An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. | |
| 15. <input checked="" type="checkbox"/> | A FIRST preliminary amendment. | |
| 16. <input type="checkbox"/> | A SECOND or SUBSEQUENT preliminary amendment. | |
| 17. <input type="checkbox"/> | A substitute specification. | |
| 18. <input type="checkbox"/> | A change of power of attorney and/or address letter. | |
| 19. <input checked="" type="checkbox"/> | Other items or information: INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT/IPEA/409), INTERNATIONAL SEARCH REPORT (PCT/ISA/210), APPLICATION DATA SHEET, ABSTRACT | |

U.S. APPLICATION NO. (if known, give 37 CFR 1.10)

10/009764

INTERNATIONAL APPLICATION NO.
PCT/JP00/03897ATTORNEY'S DOCKET NO.
T01-4929/TS17. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):**

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$ 1,040.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$ 890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$ 740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$ 710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$ 100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$ 890.00

Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

CLAIMS

NUMBER FILED

NUMBER EXTRA

RATE

\$

Total claims 5 - 20 = 0 X \$18.00 \$

Independent claims 2 - 3 = 0 X \$84.00 \$

MULTIPLE DEPENDENT CLAIMS(S) (if applicable) + \$280.00 \$

TOTAL OF ABOVE CALCULATIONS =

\$ 890.00

Reduction of 1/2 for filing by small entity, if applicable. Applicant claims Small Entity Status under 37 CFR 1.27 +

\$

SUBTOTAL =

\$ 890.00

Processing fee of \$130 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

TOTAL NATIONAL FEE =

\$ 890.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

\$ 40.00

TOTAL FEES ENCLOSED =

\$ 930.00

Amount to be
refunded:

charged:

a. ☒ A check in the amount of \$ **930.00** to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. **25-0120** in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required by 37 CFR 1.16 and 1.17, or credit any overpayment to Deposit Account No. **25-0120**. A duplicate copy of this sheet is enclosed.

SEND ALL CORRESPONDENCE TO:

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December 17, 2001

By

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Registration No. 35,041

Customer Number: 000466

10/009764

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Kunimoto SUGIYAMA et al.

Serial No. (unknown)

Filed herewith

METHOD FOR MANUFACTURING A FILTER ELEMENT

PRELIMINARY AMENDMENT

Commissioner for Patents

Washington, D.C. 20231

Sir:

Prior to the first Official Action and calculation of the filing fee, please substitute Claim 1 as originally filed, which appears on page 14, with Claim 1 as filed in the Article 34 amendment of March 15, 2001. The page containing Claim 1 is marked "AMENDED SHEET" and is attached hereto. Following the insertion of Claim 1, please amend these claims as follows:

IN THE CLAIMS:

Please amend claims 3-4 as follows:

--3. (Amended) The method for manufacturing a filter element as claimed in Claim 1, wherein:

said resin and material for said filter are formed of same material.

4. (Amended) A filter element manufactured by carrying out the method as claimed in claim 1.--

Kunimoto SUGIYAMA et al.

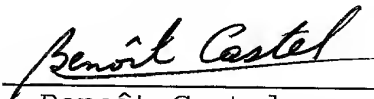
R E M A R K S

The above changes in the claims merely place this national phase application in the same condition as it was during Chapter II of the international phase, with the multiple dependencies being removed. Following entry of this amendment by substitution of the pages, only claims 1-5 remain pending in this application.

Respectfully submitted,

YOUNG & THOMPSON

By



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December 17, 2001

"VERSION WITH MARKINGS TO SHOW CHANGES MADE"

Claims 3-4 have been amended as follows:

3. (Amended) The method for manufacturing a filter element as claimed in Claim 1 ~~or 2~~, wherein:

said resin and material for said filter are formed of same material.

4. (Amended) A filter element manufactured by carrying out the method as claimed in ~~claim 1~~ any one of Claims 1 to 3.

CLAIMS

1. (Amended) A method for manufacturing a filter element, comprising the steps of:
 - supporting a filter so that at least one part of said filter is exposed;
 - semi-curing resin in a prescribed shape to prepare a semi-cured resin through a removable section in a place, which is apart from the exposed part of said filter so as to face the exposed part thereof, and hold it;
 - removing the removable section and bringing said semi-cured resin into contact with the exposed part of said filter, to insert forcibly the part of said filter into said semi-cured resin; and
 - curing said semi-cured resin into which the part of said filter has been forcibly inserted.
2. The method for manufacturing a filter element as claimed in Claim 1, wherein:
 - said filter is a tubular filter, and said at least one part of said filter, which is to be forcibly inserted into said semi-cured resin, is opposite ends of said tubular filter.
3. The method for manufacturing a filter element as claimed in Claim 1 or 2, wherein:
 - said resin and material for said filter are formed of same material.
4. A filter element manufactured by carrying out the method as claimed in any one of Claims 1 to 3.
5. A mold for manufacturing a filter element, comprising:
 - a supporting member for supporting a filter so that at least one part of said filter is exposed; and
 - a semi-curing mold member for semi-curing resin in a prescribed shape, said semi-curing mold section having a holding section for holding at least a semi-cured resin and a removable section, which is removed to expose at least one part of said semi-cured resin, said removable section being disposed between an exposed part of said filter and said holding section, and said holding section being disposed so that said exposed part of said filter comes into contact with an exposed part of said semi-cured resin, after removal of said removable section.

3/PRTS

JCO7 Rec'd PCT/PTO 17 DEC 2001
10/009764

SPECIFICATION

METHOD FOR MANUFACTURING A FILTER ELEMENT

TECHNICAL FIELD

5 The present invention relates to a method for manufacturing a filter element, in which a retaining member and the other members such as a sealing member made of resin are secured to a filter.

BACKGROUND OF THE INVENTION

10 In general, a filter such as an air filter and an oil filter is secured to a member having a high rigidity, such as a retaining member to compose a filter element to be used. Because the filter as manufactured is formed of material having a relatively low rigidity such as filter paper, and it is therefore difficult to mount such a filter by itself to the other member or provide a sufficient air-tightness between the filter and the other member.

15 In view of easy formability, resin is normally used for forming the above-mentioned member having a high rigidity. An insert injection is often applied to secure the rigid member on the filter.

20 Such an insert injection can be applied to manufacture of the filter having a simple shape. However, the insert injection may not be applied to manufacture the filter having a complicated shape. More specifically, some consideration is needed to bring the filter into contact with the mold so as to prevent resin from spreading over any portions of the filter, excluding its portions to which resin body is to be formed. The complicated shape of the filter however leads to complication of the mold.

25 There may be a case in which the mold cannot be formed due to its complexity, causing a problem. When an attempt is made to form a

resin-molded body on each of the opposite ends of a tubular filter having a complicated shape such as a chrysanthemum shape by the insert injection, a mold placed in the filter cannot be removed, thus causing a problem. It is substantially impossible to apply the inert injection to the
5 opposite ends of such a filter.

DISCLOSURE OF THE INVENTION

An object of the present invention, which was made in view of the above-mentioned problems, is therefore to provide a method for manufacturing a filter element having a resin-molded frame, which
10 permits to easily form the resin-molded frame, even when the filter has a complicated shape.

In order to attain the aforementioned object, a method of the present invention for manufacturing a filter element, comprises the steps of:

15 semi-curing resin in a prescribed shape to prepare a semi-cured resin;

inserting forcibly at least one part of a filter into said semi-cured resin; and

20 curing said semi-cured resin into which said at least one part of said filter has been forcibly inserted.

According to the present invention, a part of the filter is inserted into the semi-cured resin, and then, the semi-cured resin is completely cured. As a result, a mold, which provides a prescribed shape of resin during semi-curing the resin, suffices. A complicated shape of the filter
25 does not lead to complication of the mold. It is therefore possible to form a molded body of resin, leading to an easy manufacture of the filter element at a low cost, even when the filter has a complicated shape.

The filter element of the present invention may preferably be applicable in case where the filter is a tubular filter and at least one part of the filter, which is to be forcibly inserted into the semi-cured resin, is opposite ends of the tubular filter. It has been substantially impossible to apply the insert injection to the opposite ends of the tubular filter, especially the tubular filter having the complicated shape to form a molded resin. It is therefore possible to apply the present invention to formation of the molded resin on the opposite ends of the tubular filter, thus putting the technical effects of the present invention to practical use.

In the method of the present invention for manufacturing the filter element, the above-mentioned resin and material for the filter may preferably be formed of same material. The feature that the above-mentioned resin, i.e., a member (such as an outer frame), which is formed on a part of the filter and has a high rigidity, and the material for the filter are formed of the same material, makes it unnecessary to separate the filter from the outer frame or the other structural component, when the filter element is recycled. It is therefore possible to recycle the filter element as it is, thus leading to an effective recycling system.

Another object of the present invention is to provide the filter element, which is manufactured by carrying out the above-mentioned method for manufacturing the filter element. A mold for such a filter element is simpler than a mold for the conventional filter element in which the molded resin is formed by the insert injection, thus reducing the manufacturing cost of the mold. No time is required to remove the mold, providing advantages in costs. In addition, it is possible to form the resin frame on the filter having a complicated shape such as a

chrysanthemum shape so as to provide the filter element in which supporting members made of resin are formed on the opposite ends of the filter, although such a formation of the resin frame cannot be performed by the conventional technique.

5 Further another object of the present invention is to provide a mold for manufacturing a filter element, comprises:

a supporting member for supporting a filter so that at least one part of said filter is exposed; and

10 a semi-curing mold member for semi-curing resin in a prescribed shape, said semi-curing mold section having a holding section for holding at least a semi-cured resin and a removable section, which is removed to expose at least one part of said semi-cured resin, said removable section being disposed between an exposed part of said filter and said holding section, and said holding section being disposed so that
15 said exposed part of said filter comes into contact with an exposed part of said semi-cured resin, after removal of said removable section.

According to such a mold, it is possible to insert quickly the part of the filter into the semi-cured resin during semi-curing the resin, to form the molded resin, even when the resin has a relatively short curing
20 time. More specifically, resin is first supplied into the semi-curing mold member. Then, the resin is semi-cured into a semi-cured state. After completion of the semi-curing step, the removable section of the semi-curing mold member is removed. Removal of the removable section causes the part of the filter, which is exposed from the holding
25 section, is placed in a position where the part of the filter can come into contact with the semi-cured resin, which has been exposed through the removal of the removable section. Then, the part of the filter, which is exposed from the holding section, is inserted quickly into the semi-cured

resin as exposed. The semi-cured resin is then cured completely. As a result, the molded resin can be formed on the part of the filter in a short period of time. It is therefore possible to easily manufacture the filter element with the use of the mold of the present invention, even when the resin has a relatively short curing time.

The method of the present invention for manufacturing the filter element is characterized by comprising the steps of: semi-curing the resin in the prescribed shape to prepare the semi-cured resin; inserting forcedly at least one part of the filter into the semi-cured resin; and curing the semi-cured resin into which the at least one part of the filter has been forcedly inserted. The mold suffices to semi-cure the resin in the prescribed shape, leading to the simple structure, even when the filter has a complicated shape. It is therefore possible to form the molded resin on the filter, thus providing effects of manufacturing easily the filter element at a low cost, even when the filter has a complicated shape.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic sectional view illustrating an example of a mold for manufacturing a filter element, which is used in the method of the present invention for manufacturing the filter element;

FIG. 2 is a schematic view illustrating an example of a manufacturing apparatus, which is used in the method of the present invention for manufacturing the filter element; and

FIG. 3 is a descriptive view illustrating an example of the steps of the method of the present invention for manufacturing the filter element.

BEST MODE FOR CARRYING OUT THE INVENTION

Now, description will be given in detail below of the method of the present invention for manufacturing a filter element.

The method of the present invention for manufacturing the filter element is characterized by comprising the steps of: semi-curing resin in a prescribed shape to prepare a semi-cured resin; inserting forcedly at least one part of a filter into the semi-cured resin; and curing the semi-cured resin into which the at least one part of the filter has been forcedly inserted.

First, description will be given of the first step, i.e., the step for semi-curing the resin in a prescribed shape. The step for semi-curing the resin in the prescribed shape is conducted by pouring the resin into a metallic mold having a cavity with the prescribed shape and semi-curing it, although the present invention is not limited only to such features. The conventional metallic molding method such as an injection molding and a casting can be applied to the above-mentioned step. The suitable molds for the respective molding methods are applicable as the mold used in the above-mentioned step. The metallic mold may be completely closed or opened on the upper side. It is preferable to use the metallic mold described later for manufacturing the filter element in the present invention, in view of effectiveness and operability of the metallic mold.

There is used, as the resin to be used, resin generally used to form an outer frame of the filter. There may be used any kind of resin, which can be semi-cured, for example, thermosetting resin such as phenol resin, melamine resin and polyurethane resin, and thermoplastic resin such as polyethylene, polypropylene, polyvinyl chloride, acrylonitrile butadiene styrene resin, and (polyolefin, polyurethane or polyester) thermoplastic elastomer (TPE).

In the present invention, it is preferable that the above-mentioned resin and material for forming the filter are formed of the same resin. The above-mentioned feature that the material for forming an outer frame, which has a high rigidity, and the material for forming the filter are formed of the same material, makes it unnecessary to separate the filter from the outer frame, when the filter element is recycled. It is therefore possible to recycle the filter element as it is, thus leading to an effective recycling system.

With respect to the resin, which is applicable in view of the fact that the above-mentioned resin and the resin for forming the filter are formed of the same material, thermoplastic resin is preferable. More specifically, there may be included polyester, polyamide, polypropylene, polyethylene, acetylcellulose, acryl and polyvinyl chloride fiber. Any kind of material, which can be used as both the fiber material and the moldable resin, may be used.

In the present invention, polyester and polyamide, which have widely been used as the moldable resin and material for forming the filter and are low-priced, are especially preferable. Polypropylene and polyethylene, which have widely been used as the moldable resin and material for forming a mesh used for the filter placed in a tank and are low-priced, are also preferable.

With respect to the semi-curing of the resin, in case where the thermosetting resin is used, selection of the resin having a relatively long curing time makes it possible to obtain the resin in the semi-cured state in the middle of a curing reaction of the resin. In case where the thermoplastic resin is used, the resin in the semi-cured state can be obtained by making adjustment of temperature of the metallic mold to maintain a relatively long cooling period of time, after pouring the

liquefied resin into the metallic mold.

5 The above-mentioned prescribed shape means the shape that which is required for the resin, which has been cured completely. If the resin goes from the semi-cured state to the cured state to cause change in shape such as shrinkage of resin, the above-mentioned shape includes such change. Consequently, the above-mentioned prescribed shape means the shape of the frame and/or the other structural components of the filter element as the finished product.

10 In the second step, a part of the filter is forcedly inserted into the semi-cured resin. The "part" of the filter means its part on which the molded resin is formed. In the preferable embodiment, the part of the filter means the end of the filter, on which a supporting member or a sealing member is provided. In the most preferable embodiment, the part of the filter means the opposite ends of the filter.

15 In such a second step, the above-mentioned part of the filter is forcedly inserted into the semi-cured resin. In case where the molded resin is formed on each of the opposite ends of the filter, there may be carried out the steps of: inserting forcedly the one end of the filter into the semi-cured resin; curing the semi-cured resin; inserting forcedly the other end of the filter into the other semi-cured resin; and curing the other semi-cured resin. Alternatively, the opposite ends of the filter may be forcedly inserted simultaneously into the separate semi-cured resins, respectively, and these semi-cured resins may be cured completely.

25 The filter element of the present invention includes any type of the filter element such as the filter element used in a fluid filter, i.e., a fuel filter and an air filter, so long as the resin is used as the outer frame and/or the other structural components. The filter may have any shape such as a panel-shape, a roll-shape and a tubular shape. Applying the

present invention to the filter having the complicated shape, to which the conventional insert injection cannot be applied, can fully provide the effects of the present invention, leading to preferable results. It is particularly preferable to apply the present invention to the tubular filter
5 having the complicated shape such as a chrysanthemum shape.

In the present invention, the semi-cured resin into which the part of the filter has been forcibly inserted is finally cured completely. The curing conditions depend on the resin to be used. In case where the thermosetting resin is used, heat may be applied to the resin to cause continuously the curing reaction. In case where the thermoplastic resin is used, the metallic mold may be cooled to cure the resin.
10

Now, description will be given of the mold for manufacturing the filter element, which is suitably applicable to the method of the present invention for manufacturing the filter element. The mold of the present invention for manufacturing the filter element is characterized by comprising: a supporting member for supporting a filter so that at least one part of said filter is exposed; and a semi-curing mold member for semi-curing resin in a prescribed shape, said semi-curing mold section having a holding section for holding at least a semi-cured resin and a removable section, which is removed to expose at least one part of said semi-cured resin, said removable section being disposed between an exposed part of said filter and said holding section, and said holding section being disposed so that said exposed part of said filter comes into contact with an exposed part of said semi-cured resin, after removal of
15
20
25 said removable section.

The above-mentioned mold will be described in detail below with reference to the drawings. FIG. 1 illustrates an example of the mold of the present invention for manufacturing the filter element. The mold 1

for manufacturing the filter element is composed of a supporting member 3 for supporting the filter 2 and a semi-curing mold member 4 for semi-curing the resin in the prescribed shape.

5 In the example, the supporting member 3, which is designed to support the tubular filter 2, is obtained by forming a groove into which the filter 2 can be inserted, on a cylindrical material. When the filter 2 is inserted in the supporting member 3, the filter 2 is supported so that the one end of the filter is exposed. The supporting member 3 of the present invention may have any structure so long as it supports the filter so that the filter is partially exposed. The supporting member 3 may have the groove, which has the similar shape to the shape of the filter, as shown in FIG. 1. The supporting member 3 may have a structure, which catches a part of the filter so that the opposite ends of the filter are exposed. The principal function of the supporting member is to support the filter. Accordingly, even in a case where the supporting member has the groove into which the filter is to be inserted as shown in FIG. 1, the groove does not need to precisely coincide with the shape of the filter, but may have a rough shape by which the filter can be supported. It is therefore possible to easily manufacture the mold at a low cost in comparison with a mold, which is used in the insert injection.

10 In the mold 1 as shown in FIG. 1 for manufacturing the filter element, the semi-curing mold member 4, which is composed of a holding section 5 and a removable section 6, is placed on the supporting member 3. The holding section 5 of the semi-curing mold member 4 has a ring-shaped groove 7, by which the semi-cured resin is formed in accordance with the shape of the end of the above-mentioned tubular filter 2. The holding section 5 also has a gate 8 formed thereon, for supplying molten resin into the above-mentioned groove 7. The

removable section 6 serving as the other structural component of the mold 1 for manufacturing the filter element comes on its upper surface into contact with the holding section 5 so as to liquid-tightly close the groove 7. The removable section 6 is placed on the supporting member 3 so as to be removable after the groove 7 is filled with the resin and then the resin is semi-cured. Even when the removable section 5 is removed, the semi-cured resin is held in the groove 7.

In the example, the semi-curing mold member 4 is composed of two structural parts, i.e., the holding section 5 and the removable section 6. The present invention is not limited only to such a structure. The semi-curing mold member may be divided into three or more parts so long as it has the holding section for holding the semi-cured resin and the removable section, which is removed to expose the part of the semi-cured resin. Here, the "holding the semi-cured resin" means to hold the semi-cured resin without moving after removal of the removable section, and the above-mentioned "holding" means to hold the semi-cured resin until the part of the filter is forcedly inserted into the semi-cured resin as exposed, after the removal of the removable section.

In the example as shown in FIG. 1, the groove 7 is filled with the resin and the removable section 6 is then removed after the supplied resin is semi-cured. During such a removal operation, the groove 7 for holding the semi-cured resin is placed so as to face the upper end of the filter 2 supported by the supporting member 3. Moving down simply the holding section 5 causes the upper end of the filter 2 to be forcedly inserted into the semi-cured resin in the groove 7.

Now, an example of the method of the present invention for manufacturing the filter element, utilizing the above-mentioned mold 1 for manufacturing the filter element will be described with reference to

FIGS. 2 and 3. FIG. 2 is a schematic view illustrating the example of the manufacturing apparatus, which is used in the manufacturing method of the present invention. The manufacturing apparatus 9 comprises a turntable 11, on which a mold unit 10 having two molds 1 for manufacturing the filter member can be placed and which is turnable; and a supplying device 12 for supplying the resin into the mold unit 10. The turntable 11 turns to move the mold unit 10, which are placed on the turntable 11, between a formation/insertion area 13 in which the steps of supplying the resin and curing it are carried out and an insertion/reversing area 14 in which the filter is inserted and reversed.

The manufacturing method utilizing the above-mentioned manufacturing apparatus 9 will be described with reference to FIGS. 2 and 3. First, the filter 2 is inserted into the groove of the left-hand supporting member 3 of the mold unit 10, which is placed in the insertion/reversing area 14, so as to hold the filter 2 therein (see FIG. 3(a)). Then, the above-mentioned semi-curing mold section 4 is placed on the supporting member 3 (see FIG. 3(b)). Then, turning the turntable 11 causes the mold unit 10 to move into the formation/insertion area 13. The molten resin is supplied into the left-hand semi-curing mold section 4 of the mold unit 10 as moved, from the supplying device 12. The removable section 6 is removed after the resin in the mold unit 10 is semi-cured (see FIG. 3(c)). Then, the upper end of the filter 2 is forcibly inserted into the semi-cured resin in the groove 7 of the holding section 5. Then, the mold unit 10 is cooled to cure the semi-cured resin completely. The turntable 11 turns to move again the mold unit 10 into the insertion/reversing area 14. The holding section 5 of the mold unit 10 as moved is removed and the filter 2 supported therein is taken out. The filter 2 thus pulled out is turned upside down and then inserted into the groove of the right-hand supporting member 3 so that the end of the

filter 2, on which the molded resin 15 has been formed, is directed downward (see FIG. 3(d)). In this case, the new filter may be inserted into the groove of the left-hand supporting member to carry out the steps for manufacturing the next filter element. After the filter 2 is turned
5 upside down and inserted, the semi-curing mold section 4 is placed on the supporting member 3 (see FIG. 3(e)). The turntable 11 turns to move the mold unit 10 into the formation/insertion area 13. The resin is inserted into the groove 7 of the semi-curing mold section 4 with the use of the supplying device 12 in the same manner as described above.
10 The resin is then semi-cured. The removable section 6 is removed so that the other end of the filter 2, on which the molded resin 15 has not as yet been formed, is forcibly inserted into the semi-cured resin (see FIG. 3(f)). After the resin is cured completely, the turntable 11 turns to move the mold unit 10 into the insertion/reversing area 14. Then, the
15 filter 2 is taken out from the supporting member 3. The filter element 16 having the molded resin 15 on the opposite ends thereof is obtained in this manner (see FIG. 3(g)).

The present invention is not limited only to the above-described embodiments. The embodiments are merely described by way of
20 illustration. Any invention, which has the structure based on substantially the same technical idea as that defined in claims and provides the same effects, is included in the technical scope of the present invention.

In the above description, the mold for molding the resin is
25 described as a metallic mold. The mold is however not limited only to the metallic mold, and may be a mold made of resin.

WHAT IS CLAIMED IS:

1. A method for manufacturing a filter element, comprising the steps of:

semi-curing resin in a prescribed shape to prepare a semi-cured resin;

- 5 inserting forcibly at least one part of a filter into said semi-cured resin; and

curing said semi-cured resin into which said at least one part of said filter has been forcibly inserted.

2. The method for manufacturing a filter element as claimed in Claim 1, wherein:

said filter is a tubular filter, and said at least one part of said filter, which is to be forcibly inserted into said semi-cured resin, is opposite ends of said tubular filter.

3. The method for manufacturing a filter element as claimed in Claim 1 or 2, wherein:

said resin and material for said filter are formed of same material.

4. A filter element manufactured by carrying out the method as claimed in any one of Claims 1 to 3.

5. A mold for manufacturing a filter element, comprising:

a supporting member for supporting a filter so that at least one part of said filter is exposed; and

- 5 a semi-curing mold member for semi-curing resin in a prescribed shape, said semi-curing mold section having a holding section for holding at least a semi-cured resin and a removable section, which is

removed to expose at least one part of said semi-cured resin, said removable section being disposed between an exposed part of said filter and said holding section, and said holding section being disposed so
10 that said exposed part of said filter comes into contact with an exposed part of said semi-cured resin, after removal of said removable section.

FIG. 1

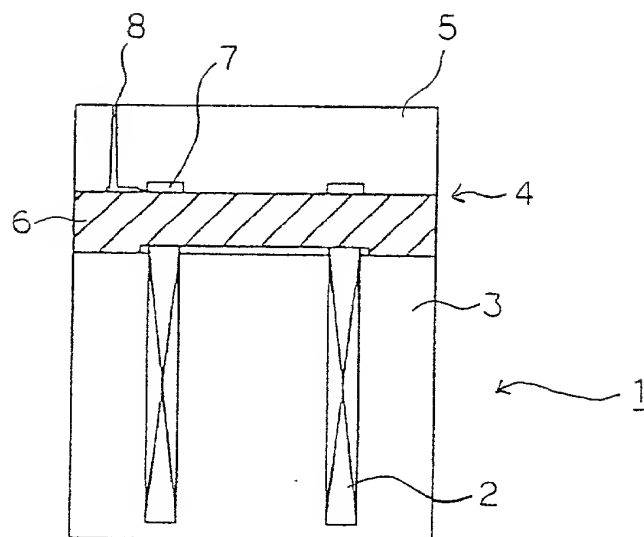


FIG. 2

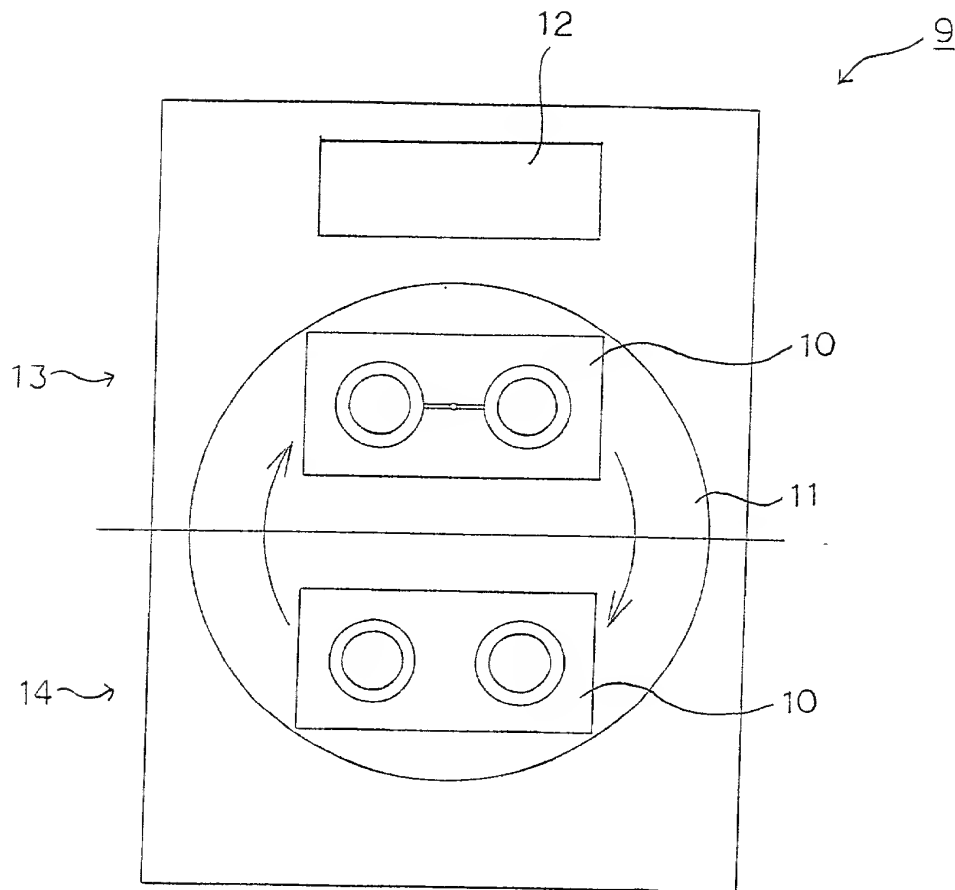


FIG. 3(a)

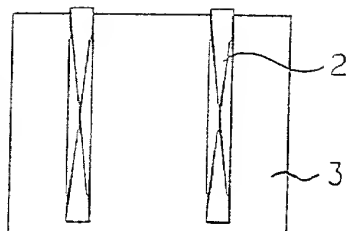


FIG. 3(d)

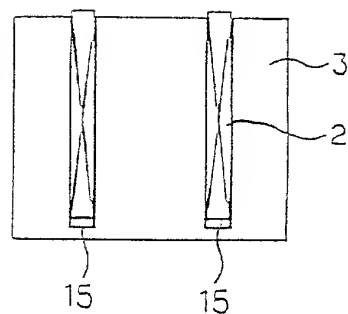


FIG. 3(b)

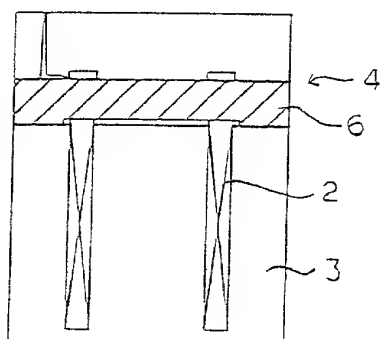


FIG. 3(e)

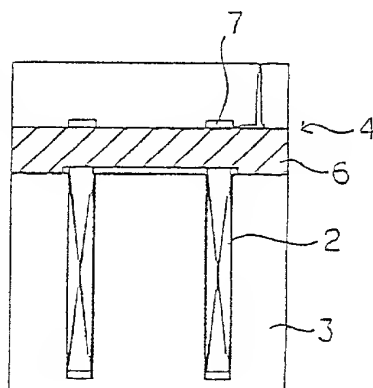


FIG. 3(c)

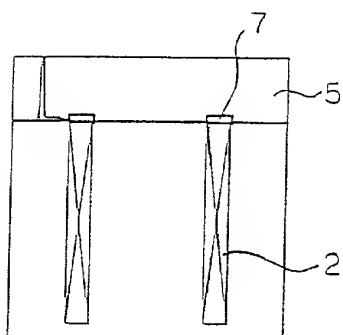


FIG. 3(f)

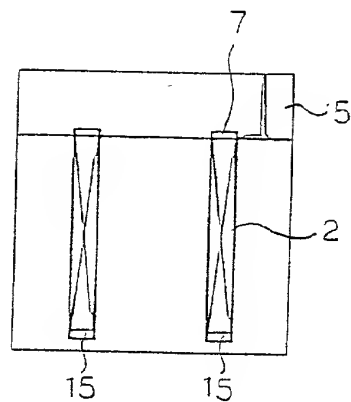
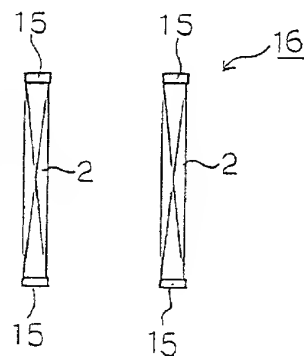


FIG. 3(g)



Declaration and Power of Attorney For Patent Application

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者（下記の名称が複数の場合）であると信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

METHOD FOR MANUFACTURING A FILTER ELEMENT

上記発明の明細書は、

☐ 本書に添付されています。

☐ ____月____日に提出され、米国出願番号または特許協定条約国際出願番号を____とし、
(該当する場合) ____に訂正されました。

the specification of which

☐ is attached hereto.

☒ was filed on June 15, 2000
as United States Application Number or
PCT International Application Number
PCT/JP00/03897 and was amended on
____ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

Japanese Language Declaration

(日本語宣言書)

私は、米国法典第35編119条 (a) - (d) 項又は365条 (b) 項に基づき下記の、米国以外の国の少なくとも一カ国を指定している特許協力条約365 (a) 項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

Prior Foreign Application(s)

外国での先行出願

| | |
|------------|-----------|
| P11-168038 | Japan |
| (Number) | (Country) |
| (番号) | (国名) |
| P11-306519 | Japan |
| (Number) | (Country) |
| (番号) | (国名) |

私は、第35編米国法典119条 (e) 項に基づいて下記の米国特許出願規定に記載された権利をここに主張いたします。

| | |
|-------------------|---------------|
| (Application No.) | (Filing Date) |
| (出願番号) | (出願日) |

私は、下記の米国法典第35編120条に基づいて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約365条 (c) に基づく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第35編112条第1項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第37編1条56項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

| | |
|-------------------|---------------|
| (Application No.) | (Filing Date) |
| (出願番号) | (出願日) |

| | |
|-------------------|---------------|
| (Application No.) | (Filing Date) |
| (出願番号) | (出願日) |

私は、私自信の知識に基づいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じるところに基づく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編第1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

| | |
|------------------------|---|
| 15/06/1999 | Priority Claimed |
| (Day/Month/Year Filed) | 優先権主張 |
| (出願年月日) | |
| 28/10/1999 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| (Day/Month/Year Filed) | はい いいえ |
| (出願年月日) | |

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

| | |
|-------------------|---------------|
| (Application No.) | (Filing Date) |
| (出願番号) | (出願日) |

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.

| |
|--|
| (Status: Patented, Pending, Abandoned) |
| (現況: 特許許可済、係属中、放棄済) |

| |
|--|
| (Status: Patented, Pending, Abandoned) |
| (現況: 特許許可済、係属中、放棄済) |

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration

(日本語宣言書)

委任状：私は下記の発明者として、本出願に関する一切の手続きを米特許商標局に対して遂行する弁理士または代理人として、下記の者を指名いたします。

(弁理士、または代理人の指名及び登録番号を明記のこと)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

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(第三以降の共同発明者についても同様に記載し、署名すること)

(Supply similar information and signature for third and subsequent joint inventors.)